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J. E. Satchell and T. R. E. Southwood

The Heteroptera of some Woodlands in the English Lake District

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TRANSACTIONS OF THE SOCIETY
FOR BRITISH ENTOMOLOGY

VOL. 15 JUNE 1963 PART VII

The Heteroptera of some Woodlands in the English Lake District

By J. E. Satchell
(The Nature Conservancy, Merlewood Research Station, Grange-over-Sands, Lancs.)

and

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In 1953-54, preliminary surveys were made of a number of invertebrate groups in possible research sites in the vicinity of the then newly-established Merlewood Research Station at Grange-over-Sands. This paper reports part of this work in which the Heteroptera were surveyed in a number of woodlands in the south Lake District. The results are of a preliminary nature, but provide additional information for an area where the Heteroptera had previously been little studied. The full data are retained at Merlewood Research Station.

Methods and Sites

The main survey was conducted during the last two weeks of July 1954, when thirty-one different woodlands were visited; one of larch, four each of yew and of pine, seven each of birch and of oak, and eight of mixed ash wood. Within each wood the following operations were carried out and all the Heteroptera found were collected: —

a. Ten boughs were beaten from each of the major trees and shrubs (see table 2).

b. A 20-yard sweep (with an 18-inch mouth diameter net) was made through each of the major plants of the herb layer.

c. Five tree trunks were searched from three to six feet above ground level.

d. Five samples, each one foot square, of litter were collected and taken back to the laboratory for sorting.

TABLE 1

Location of Sites

Woodland Sites

Acid Peat Mosses

(a) *Pine Woods*

	Nat. Grid Ref.		Nat. Grid Ref.
1. Holker Moss, Lancs.	(348803)	2. Rusland Moss, Lancs.	(333888)
3. Ireland Moss, Lancs.	(332844)	4. Stakes Moss, Westm.	(462846)

(b) *Birch Woods*

5. Burton Moss, Lancs.	(504768)	6. Catcragg Moss, Westm.	(444823)
7. Deanholme Moss, Lancs.	(341819)	8. Ellerside Moss, Lancs.	(351795)
9. Foulshaw Moss, Westm.	(461838)	10. Fritz's Piece, Lancs.	(351785)
11. Helsingford Moss, Westm.	(471893)	12. Rusland Moss, Lancs.	(335885)

Acid Soils on Slates

Oak Woods

13. Craggs, Westm.	(475987)	14. Devil's Gallop, Lancs.	(362947)
15. Great Tower, Lancs.	(396915)	16. Lakeside, Lancs.	(373869)
17. Longsleddale, Westm.	(509019)	18. Low Wood, Westm.	(429870)
19. Roudsea, Lancs.	(331822)	20. Stockbird Head, Lancs.	(325843)
		21. Great Tower, Lancs.	(394914)

Base Rich Soils on Limestone

(a) *Mixed Ash Woods*

22. Ashspring, Westm.	(488941)	23. Brigsteer, Westm.	(487877)
24. Cunswick Scar, Westm.	(491936)	25. Eggerslack, Lancs.	(409788)
26. High Newton, Lancs.	(397818)	27. Leasgill, Westm.	(502840)
28. Jemmy Fell, Lancs.	(405806)	29. Plumpton Cottage, Lancs.	(318800)
30. Roudsea, Lancs.	(333825)	31. Sizergh, Westm.	(505880)
32. Witherslack, Westm.	(440863)	33. Humphrey Head, Lancs.	(390742)
34. Meathop, Westm.	(436800)	35. Old Park, Lancs.	(338782)
36. Roudsea, Lancs.	(335819)		

(b) *Larch Wood*

37. Eggerslack, Lancs. (411785)

(c) *Pine Wood*

38. Meathop, Westm. (433793)

Non-Woodland Sites

39. Merlewood, Lancs.	(408795)	40. Whitbarrow, Westm.	(445855)
41. Skelwith Bridge, Westm.	(356037)	42. Fell Foot, Lancs.	(385872)
43. Light Beck, Westm.	(478924)	44. Otter Bank, Westm.	(535971)
45. Gilpin Park, Westm.	(507975)	46. Kendal Quarry, Westm.	(509928)

Collections were also made in June 1954 in sites 12, 13, 17, 21, 25, 27, 34, 35, and in June only in sites 8, 14, 26, 29, 37. Additional collections were made from litter in some woodland sites in the autumn of 1953. Collections were made from roadside verges or other habitats in the vicinity of some of the woodlands, these being indicated by the suffix (a) after the site number. These collections were not standardised, and casual collections were also made from sites 39-46. Collections made from pteridophytes are shown in table 6; besides pteridophytes the following plants were swept in the sites shown in parentheses: —

Pine Woods—*Molinia caerulea* Moench. (1, 2, 4); *Vaccinium myrtillus* Linn. (2).

Birch Woods—*Molinia caerulea* (5, 6, 7, 9, 10, 12), *Calluna vulgaris* Salisb. (6, 9, 11), *Galium palustre* Linn. (6, 12), *Digitalis purpurea* Linn. (7), *Erica cinerea* Linn. (11), *Carex* sp., *Holcus* sp., *Juncus* sp., *Poa* sp. (12).

Oak Woods—*Deschampsia flexuosa* (Linn.) (13, 15, 16, 17, 18, 20), *Holcus* sp. (15, 17, 18, 19), *Rubus* agg. (18, 10), *Circaea lutetiana* Linn. (17), *Teucrium scorodonia* Linn. (18), *Dactylis glomerata* Linn., *Digitalis purpurea, Phleum pratense* Linn. (19), *Stachys sylvatica* Linn. (20).

Mixed Ash Woods—*Mercurialis perennis* Linn. (22, 23, 24, 25, 27, 30, 31), *Circaea lutetiana* (22, 23, 24, 25, 27, 31), *Rubus* agg. (22, 23, 24, 25, 27, 31), *Stachys sylvatica* (22, 23, 24, 31), *Holcus* sp. (24, 27, 30), *Melandrium rubrum* (22, 27, 31), *Teucrium scorodonia* (23, 25), *Urtica dioica* Linn. (30, 32), *Epilobium hirsutum* Linn. (22), *Agropyron caninum* Beauv., *Hypericum perforatum* Linn., *Origanum vulgare* Linn. (23), *Agrostis* sp., *Juncus* sp. (24), *Rosa canina* Linn. (25), *Prunella vulgaris* Linn. (27), *Deschampsia flexuosa* (30).

Yew Woods—*Mercurialis perennis* (33, 34, 35, 36), *Circaea lutetiana, Solanum dulcamara* Linn. (33).

Casual collections—*Holcus* sp. (3a, 6a, 8a, 11a, 39, 42, 46), *Stachys sylvatica* (9a, 12a, 38a, 39, 44, 46), *Urtica dioica* (3a, 5a, 9a, 17a, 39), *Sarothamnus scoparius* (Link.) (20a, 43, 44), *Cirsium palustre* Linn. (5a, 9a), *Lotus* sp. (5a, 46), *Ulex europaeus* Linn. 3a, 20a), *Melandrium rubrum* (9a, 17a), *Epilobium hirsutum* (9a, 39), *Rhododendron ponticum* (1a), *Galium palustre, Succisa pratensis* (Linn.) (5a), *Rubus* agg. (12a), *Geranium robertianum* Linn. (38a), *Allium ursinum* Linn. (39), *Teucrium scorodonia* (40), *Hieracium* sp., *Festuca* sp. (43), *Arrhenatherum elatius* (Linn.), *Cynosurus cristatus* Linn., *Dactylis glomerata, Thymus serpyllum* Linn. (46).

Oak trees were beaten at site 39, and birch at 41; site 33a was a salt marsh, and 45 an upland pasture.

Identifications

Collections were preserved in alcohol with a little formalin and identified by one of us (T.R.E.S.). All identifications of *Psallus* spp. were checked by examination of the genitalia. A very small number of larvae could not be identified, and the majority of *Phytocoris* and a few *Psallus* larvae could only be allocated to genus. The nomenclature and classification is that of Southwood & Leston (1959) with a few modifications (Leston and Southwood (1963)).

The Heteroptera of the Different Woodlands

Qualitative differences in the Heteroptera of the various woodlands were, as expected, largely reflections of their different floras.

Mixed Ash Woods (= Ash-oak woods)

These woods had the richest flora with seven tree or shrub species compared with not more than two in the other woods. It is thus not surprising that more species (44) of Heteroptera were found in this type of wood than in any other. The arboreal species recorded are shown in table 2. The most interesting comparison is with the oak woods on acid soils in which many fewer Heteroptera were collected. To some extent, but not entirely, this is accounted for by the smaller numbers of *A. nemorum* in oak woods than in the mixed ash woods. Excluding this species, the mean number of individuals from ten boughs in the oak wood was 14, whilst in the mixed ash wood it was 53. We found, however, no qualitative difference between the faunas of the oak trees in the two types of woodland. Other arboreal species and the number of specimens (in parentheses) taken in these woods in July, but not listed in table 2, were *Orthops cervinus* (8), *Cyllecoris histrionicus* (1), *Orthotylus prasinus* (25), *Phytocoris ulmi* (1), *Phylus palliceps* (2), *Phytocoris longipennis* (2), *Anthocoris gallarum-ulmi* (2), *A. minki* (1), *Temnostethus gracilis* (25), *Loricula elegantula* (11).

The fauna of the ground flora was also varied. *Calocoris alpestris, C. sexguttatus* and *Lygocoris pabulinus,* associated mostly with *Rubus* and *Urtica,* were all abundant and widespread. *Mecomma ambulans* was always taken on the grass and herbage at the edge of the rides, and various Dicyphinae were found when their host plants were present. *Bryocoris pteridis* was abundant in most woods of this type (table 5). *Monalocoris filicis* was widespread but less numerous. In the leaf litter, one *Ceratocombus coleoptratus*, and numbers of larvae of *Drymus brunneus* were found.

Oak Woods

These woodlands have a poorer flora than the mixed ash woods, and fewer Heteroptera. Besides the arboreal species listed in table 2, *Phylus palliceps* (1), *Cyllecoris histrionicus* (2) and *Temnostethus gracilis* (3) were taken in the July survey. *Anthocoris nemorum,* which breeds on both trees and herbs during its annual life-cycle, was strikingly less numerous than in the mixed ash wood. This can be associated with the sparse ground flora in the oak woods—mainly of grasses and especially *Deschampsia*. The fauna of the limited ground flora consisted of grass-feeding species, especially *Stenodema holsatum* and other Stenodemini. *Mecomma ambulans* was abundant in six of the seven oak woods. *Dicyphus pallicornis* was taken on foxgloves (*Digitalis*) in Roudsea Wood.

TABLE 2.

The number of specimens of the more abundant species of Hemiptera Heteroptera taken on trees or shrubs in July 1954 from beating 10 boughs. (The number of sites is given in brackets.)

	Species	ACID PEAT MOSSES				ACID SOILS ON SLATE	
		PINE WOODS		BIRCH WOODS		OAK WOODS	
		Pine	Alder	Sallow	Birch	Birch	Oak
Pine species	Acompocoris pygmaeus	22 (4)	—	—	1 (1)	—	—
	Psallus roseus	—	—	32 (4)	—	—	—
	Troilus luridus	—	—	—	10 (5)	—	—
	Orthotylus marginalis	—	1 (1)	28 (5)	5 (4)	—	—
Birch and Sallow species	Anthocoris nemoralis	1 (1)	—	13 (3)	16 (4)	—	—
	Blepharidopterus angulatus	—	9 (1)	3 (1)	50 (5)	4 (1)	—
	Psallus falleni	—	—	—	1 (1)	5 (3)	—
	Psallus betuleti	—	—	—	—	4 (2)	1 (1)
	Lygocoris contaminatus	2 (1)	1 (1)	13 (4)	61 (6)	14 (4)	1 (1)
	Anthocoris nemorum	5 (2)	2 (1)	50 (4)	144 (7)	61 (4)	13 (4)
Ubiquitous species	Phytocoris spp.	—	—	2 (2)	5 (4)	32 (3)	12 (4)
	Pentatoma rufipes	1 (1)	2 (1)	—	3 (2)	6 (2)	5 (4)
	Temnostethus gracilis	3 (1)	—	—	—	—	2 (2)
	Psallus perrisi	—	2 (1)	1 (1)	5 (1)	3 (2)	7 (5)
	Anthocoris confusus	1 (1)	—	—	—	3 (2)	1 (1)
	Orthotylus tenellus	—	—	—	—	1 (1)	7 (2)
	Psallus varians	—	—	—	—	—	8 (5)
	Phylus melanocephalus	—	—	—	—	—	5 (4)
Mixed ash wood species	Psallus massei	—	—	—	—	1 (1)	9 (3)
	Psallus ambiguus	—	2 (1)	1 (1)	—	1 (1)	—
	Phylus coryli	—	—	—	—	—	—
	Orthotylus viridinervis	—	—	—	—	—	—
	Campyloneura virgula	—	—	—	—	—	—
	Psallus lepidus	—	—	—	—	—	—
	Psallus flavellus	—	—	—	—	—	—

TABLE 2—*Continued.*

	Species	BASE RICH SOILS ON LIMESTONE MIXED ASH WOODS Oak	Hazel	Ash	Sycamore	Birch	Wych Elm	Hawthorn
Pine species	Acompocoris pygmaeus	—	—	—	—	—	—	—
	Psallus roseus	—	—	—	—	—	—	—
	Troilus luridus	—	—	5 (1)	1 (1)	—	—	—
	Orthotylus marginalis	—	—	—	—	—	—	—
Birch and Sallow species	Anthocoris nemoralis	1 (1)	2 (2)	—	—	3 (2)	1 (1)	—
	Blepharidopterus angulatus	—	19 (4)	8 (3)	4 (1)	14 (4)	5 (1)	—
	Psallus falleni	—	1 (1)	—	—	—	—	—
	Psallus betuleti	—	—	—	—	—	—	—
	Lygocoris contaminatus	10 (5)	10 (3)	4 (4)	1 (1)	25 (5)	—	—
	Anthocoris nemorum	68 (6)	273 (7)	76 (7)	83 (5)	187 (6)	55 (1)	6 (1)
Ubiquitous species	Phytocoris spp.	13 (4)	27 (4)	3 (3)	8 (4)	14 (4)	—	2 (1)
	Pentatoma rufipes	1 (1)	1 (1)	—	—	—	1 (1)	—
	Temnostethus gracilis	1 (1)	1 (1)	—	1 (1)	—	—	—
	Psallus perrisi	1 (1)	1 (1)	—	2 (1)	—	—	—
	Anthocoris confusus	2 (1)	1 (1)	1 (1)	1 (1)	—	—	—
	Orthotylus tenellus	3 (1)	1 (1)	1 (1)	—	1 (1)	—	—
	Psallus varians	3 (3)	2 (2)	—	—	—	—	—
	Phylus melanocephalus	2 (2)	—	—	—	—	—	—
Mixed ash wood species	Psallus massei	—	—	—	—	—	—	—
	Psallus ambiguus	—	18 (5)	—	—	2 (1)	—	—
	Phylus coryli	1 (1)	22 (5)	1 (1)	1 (1)	—	—	—
	Orthotylus viridinervis	—	—	1 (1)	—	1 (11)	5 (2)	—
	Campyloneura virgula	—	—	1 (1)	1 (1)	—	1 (1)	1 (1)
	Psallus lepidus	4 (2)	1 (1)	7 (4)	2 (1)	—	—	—
	Psallus flavellus	—	—	12 (4)	—	—	—	—

Birch Woods

It is interesting to compare the fauna on birch in these woods with that found on birch trees in other types of woodland. The most strikingly different distribution was that of the predatory Pentatomid, *Troilus luridus,* which was found in five of the seven mosses and only twice elsewhere. *Blepharidopterus angulatus* and *Anthocoris nemoralis,* both predatory species, were also more abundant in the mosses. The differences in the species recorded from birch on the mosses and elsewhere were due partly to errants from adjacent trees. *Orthotylus marginalis,* for example, was found on birch only on the mosses where its host, sallow, occurs. *Kleidocerys resedae* (Helsingford Moss) and *Elasmucha grisea* (Ellerside and Rusland Mosses) were also taken on birch in the mosses. *Phytocoris populi* (5), *Temnostethus gracilis* (5), *Loricula elegantula* (19) and *L. pselaphiformis* (1) were found on the trunks of birch trees in these woods.

The fauna of the ground flora was very diverse containing species associated with heather (*Kleidocerys truncatulatus, Orthotylus ericetorum*), swamp forms (*Cymus glandicolor, Polymerus palustris*), and others related to particular host plants. The most constant and characteristic species were *Dolichonabis limbatus, Mecomma ambulans, Bryocoris pteridis, Monalocoris filicis* and *Stenodema holsatum.*

Pine woods

These woods had a comparatively sparse heteropterous fauna. *Acompocoris pygmaeus* was the only typical pine species taken in any numbers; single specimens of *Camptozygum pinastri* were taken on pine at Stakes Moss and at Meathop, and larvae, thought to be *Phytocoris pini,* at Stakes and Holker Mosses. The typical species found on the ground flora were *Dolichonabis limbatus, Bryocoris pteridis* and *Monalocoris filicis.*

Yew Woods

These had the sparsest fauna. At Humphrey Head, two larvae of *Anthocoris nemorum,* one female *Loricula pselaphiformis* and one female *Campyloneura virgula,* all predatory species, were collected from the trees by beating. At the other sites (32, 34, and 35) no Heteroptera were found on the trees on either the foliage or trunks. The ground flora was dominated by *Mercurialis perennis*; no Heteroptera are associated with this plant and only in Witherslack were any found on it (one *Orthotylus tenellus,* two *Lygocoris pabulinus* and one *Blepharidopterus angulatus*).

Biological Notes on Some of the Species Taken

A list of the 108 species of Heteroptera found is given in tables 3 and 4. The Lancashire list previously contained 141 species of terrestrial Heteroptera, that for Westmorland 88

species (Massee, 1955). The present survey has added 26 and 34 species respectively to the two lists. The total British list of terrestrial bugs contains about 440 species many of which have mediterranean or continental distributions (Southwood, 1957). Bearing in mind the northern situation of the area and the habitats studied it seems likely that a high proportion of the available species was found in the present survey.

Acanthosomatidae and Pentatomidae

Three out of the five British Acanthosomatidae were taken and it is interesting to compare the relative abundance of the members of this family in the north of the country with that of the Pentatomidae. Although three of the four British predatory Pentatomids were found, only one of the fifteen supposedly vegetarian members of the Pentatomidae, *Pentatoma rufipes,* which has an exceptional life-cycle (overwintering as a larva), was taken in the survey. *Piezodorus lituratus* is recorded from Lancashire but was not taken. Its hosts are gorse and broom, both of which were sampled. Six late instar larvae of *Picromerus bidens* were taken close together in a ride near Burton Moss, Lancashire, supporting Groves' (1956) observations on the gregarious habits of this species, exceptional for a predator.

Rhopalidae

The capture of a pair of *Rhopalus subrufus* on *Teucrium scorodonia* at Whitbarrow, near Grange-over-Sands on June 14, considerably extends the recorded northern limit of this species in Britain; it was previously believed to be confined to an area south of a line from the Wash to the Bristol Channel. A number of other invertebrates reach the northern limit of their distribution in this region e.g. *Oncomera femorata* (Coleoptera) and the ants *Formica rufa* (Satchell and Collingwood, 1955) and *Lasius fuliginosus* (Neave, 1921).

TABLE 3.

The Heteroptera found in some Lake District woodlands and adjacent habitats in June and July, 1954. New county records additional to Massee (1955), are marked L=Lancs., W=Westmorland.

		Sites where found	*Total collected (larvae and adults)*
	Acanthosomatidae		
	Acanthosoma haemorrhoidale (L.)	35	1
	Elasmostethus interstinctus (L.)	8	1
	Elasmucha grisea (L.)	8, 12	2
	Pentatomidae		
	Pentatoma rufipes (L.)	13, 19, 25, 26, 31	10
	Picromerus bidens (L.)	4, 5a, 7, 9	15
L	Troilus luridus (Fab.)	5, 6, 7, 9, 10, 23, 25	16
	Zicrona caerulea (L.)	6	2

		Sites where found	*Total collected (larvae and adults)*
	Rhopalidae		
W	Rhopalus subrufus (Gmelin)	40	2
	Lygaeidae		
	Nysius ericae (Schilling)	46	1
LW	Kleidocerys resedae (Panzer)	1a, 11	5
	Drymus brunneus (Sahlberg)	1, 3, 7, 9, 10, 17, 30, 36	28
	Scolopostethus thompsoni Reuter	5a, 9a, 32	6
	Lygaeidae larvae—unidentified		2
	Berytinidae		
L	Cymus glandicolor Hahn	12	4
	Tingidae		
W	Tingis cardui (L.)	9a	1
	Nabidae		
	Nabis flavomarginatus Scholtz	46	3
L	Nabis ericetorum Scholtz	1	1
W	Stalia major (Costa)	46	1
	Dolichonabis limbatus (Dahlbom)	1, 2, 4, 5, 7, 8a, 9, 11a, 12, 19, 23, 38a, 46	45
	Cimicidae		
	Temnostethus gracilis (Horvath)	2, 9, 12, 15, 16, 22, 24, 27, 29, 30, 31.	46
	Anthocoris confusus Reuter	3, 11, 13, 17, 18, 20, 24, 25, 27, 29, 35	19
LW	Anthocoris minki Dohrn	28, 31	10
	Anthocoris nemoralis (Fab.)	4, 7, 9, 10, 11, 22, 27, 29, 30, 35	48
LW	Anthocoris gallarum-ulmi (De Geer)	27, 30	2
	Anthocoris nemorum (L.)	2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 22, 23, 24, 25, 26, 27, 29, 30, 31, 32, 33, 35, 46	1405
	Acompocoris pygmaeus (Fallén)	1, 2, 3, 4, 9	23
L	Xylocoris cursitans (Fallén)	12a	22
	Microphysidae		
L	Loricula pselaphiformis Curtis	12, 28, 33	3
W	Loricula elegantula (Bärensprung)	7, 24, 29, 30, 31	32
	Miridae		
	Bryocorinae		
	Monalocoris filicis (L.)	1, 2, 3, 4, 5, 6, 7, 9, 11, 17, 18, 19, 20, 22, 23, 24, 25, 27, 30, 31, 39, 40	381
	Bryocoris pteridis (Fallén)	1, 2, 3, 4, 5, 6, 7, 9, 11, 17, 18, 19, 22, 23, 24, 25, 27, 30	472

		Sites where found	Total collected (larvae and adults)
	Phylinae		
	Tinicephalus hortulanus (Meyer-Dür)	35	1
	Amblytylus brevicollis Fieber	19	1
L	Harpocera thoracica (Fallén)	13, 1, 4, 25, 27, 31	16
	Phylus palliceps Fieber	17, 25, 35,	7
	Phylus melanocephalus (L.)	12, 13, 15, 17, 18, 27, 30, 35	9
LW	Phylus coryli (L.)	22, 23, 27, 29, 30, 31, 32, 35	36
	Psallus betuleti (Fallén)	8, 12, 16, 18, 24, 25, 30, 35, 41	31
	Psallus ambiguus (Fallén)	11, 12, 14, 15, 22, 24, 25, 27, 29, 32	46
LW	Psallus perrisi (Muls. & Rey.)	8, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 25, 26, 27, 31, 32, 35	206
L	Psallus wagneri Ossiannilsson	39	1
LW	Psallus quercus (Kirschbaum)	14, 41	10
	Psallus roseus (Fab.)	5, 9, 10, 11	32
LW	Psallus flavellus Stichel	22, 24, 25, 27	13
	Psallus falleni Reuter	35	10
W	Psallus masseei Woodroffe	13, 15, 16, 18, 24, 32	13
	Psallus varians (Herrich-Schäffer)	8, 12, 13, 14 15, 16, 17, 19, 20, 22, 24, 25, 26, 27, 29, 30, 31, 32, 35	196
L	Atractotomus magnicornis (Fallén)	21	6
	Plagiognathus arbustorum (Fab.)	5a, 8a, 9a, 11a, 12a, 19 20. 23, 24, 30, 38a, 44, 46.	83
	Plagiognathus chrysanthemi (Wolff)	5a, 43, 46	19
	Chlamydatus pullus (Reuter)	5a, 46	12
LW	Asciodema obsoletum (Fieber)	3a, 20a, 43, 44	17
	Dicyphinae		
	Macrolophus rubi Woodroffe	31	1
L	Macrolophus nubilis (Herrich-Schäffer)	12a, 20, 22	3
W	Dicyphus epilobii Reuter	9a	13
L	Dicyphus errans (Wolff)	12a, 24	2
W	Dicyphus stachydis Reuter	22, 23, 24, 39	71
	Dicyphus pallicornis (Meyer-Dür)	19	3
W	Dicyphus globulifer (Fallén)	9a, 22, 27	4
LW	Campyloneura virgula (Herrich-Schäffer)	23. 25, 27, 33	6
	Orthotylinae		
W	Strongylocoris leucocephalus (L.)	45	1
W	Orthocephalus saltator (Hahn)	46	5
	Malacocoris chlorizans (Panzer)	32	7
	Cyllecoris histrionicus (L.)	8, 13, 14, 15, 17, 18, 19, 25, 26, 27, 29, 30, 31, 39	145

		Sites where found	Total collected (larvae and adults)
	Dryophilocoris flavoquadrimaculatus (De Geer)	13, 14, 25, 26, 27, 29, 31	32
	Heterocordylus tibialis (Hahn)	43	3
	Heterotoma planicornis (Psallus)	3a	1
	Blepharidopterus angulatus (Fallén)	6, 7, 9, 10, 11, 12, 13, 18, 22, 24, 27, 29, 30, 31, 32	118
LW	Orthotylus tenellus (Fallén)	18, 20, 22, 25, 32, 35,	33
W	Orthotylus viridinervis (Kirschbaum)	24, 27	7
L	Orthotylus marginalis Reuter	5, 6, 9, 10, 11, 12	34
W	Orthotylus prasinus (Fallén)	23	25
LW	Orthotylus ericetorum (Fallén)	4, 6, 9, 10, 11, 12	34
W	Orthotylus adenocarpi (Perris)	43	2
W	Mecomma ambulans (Fallén)	3, 6, 7, 9, 11a, 12, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25, 27, 30, 31	65
	Mirinae		
	Pithanus maerkeli (Herrich-Schäffer)	5, 8a, 15, 17	6
	Lygus wagneri Remane	32, 35	3
	Liocoris tripustulatus (Fab.)	9a, 32	4
	Orthops cervinus (Herrich-Schäffer)	25, 27, 39	10
	Lygocoris pabulinus (L.)	2, 4, 5a, 9a, 12, 18, 20, 22, 23, 24, 25, 27, 30, 31, 32, 39	64
W	Lygocoris contaminatus (Fallén)	1, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 18, 22, 23, 24, 25, 27, 29, 30, 31, 35	184
	Lygocoris lucorum (Meyer-Dür)	2a, 5a	3
LW	Camptozygum pinastri (Fallén)	4, 37	2
L	Polymerus palustris (Fallén)	8a, 12	4
	Miris striatus (L.)	14, 15, 25, 27	6
L	Calocoris quadripunctatus (Villers)	13, 15, 25, 26, 27, 29, 31	39
	Calocoris sexguttatus (Fab.)	5a, 9a, 17a, 19, 22, 23, 25, 27, 30, 31, 32, 39	55
	Calocoris alpestris (Meyer-Dür)	25, 27, 30, 31, 39	36
W	Calocoris roseomaculatus (De Geer)	46	11
W	Calocoris norvegicus (Gmelin)	5a, 8a, 32, 38a, 43, 46	23
W	Stenotus binotatus (Fab.)	5a, 6a, 24	6
	Phytocoris tiliae (Fab.)	20	1
W	Phytocoris populi (L.)	11	5
W	Phytocoris longipennis Flor	22	2
W	Phytocoris ulmi (L.)	23	1
	Phytocoris varipes Boheman		1
	Phytocoris spp. larvae		127
	Capsus ater (L.)	11a, 22a, 24a, 42	4
	Stenodema calcaratum (Fallén)	1, 4, 6, 8a, 11, 12	17
	Stenodema laevigatum (L.)	11a, 12, 19, 39	9
	Stenodema holsatum (Fab.)	1, 2, 6, 7, 8a, 11, 12, 19, 20, 30.	37
W	Notostira elongata (Geoffroy)	8a, 19, 30, 46	15

	Sites where found	Total collected (larvae and adults)
Trigonotylus ruficornis (Geoffroy)	13, 45, 46	18
Leptopterna ferrugata (Fallén)	11a, 45, 46	16
Leptopterna dolabrata (L.)	5a, 6a, 8a, 11a, 19, 32, 38a, 46	64
Dipsocoridae		
Ceratocombus coleoptratus (Zetterstedt)	31	4
Saldidae		
Chiloxanthus pilosus (Fallén)	33a	1
		Total 4850

Lygaeidae

Kleidocerys resedae was found on *Rhododendron ponticum* near Holker Moss. Hitherto, this species, formerly confined to alder and birch, has only been recorded from *Rhododendron* in southern England, where the change of host plant was first noticed in 1952 (Southwood and Leston, 1959); in the Lake district this species is at the northern limit of its British range.

Drymus brunneus: it is extremely interesting that this species seems to be the dominant litter Lygaeid in the area (tables 3 and 4), and *D. sylvaticus* was not taken. In southern England, *D. sylvaticus,* which is thought to be distributed throughout Britain, is in most areas more abundant.

TABLE 4.

The Heteroptera found in litter samples from some Lake District woodlands taken in November and December, 1953.

	Sites	Total collected (all adults)
Acanthosomatidae		
Acanthosoma haemorrhoidale (L).	28	1
Elasmostethus interstinctus (L.)	7, 10	3
Elasmucha grisea (L.)	6, 7	3
Lygaeidae		
Stygnocoris pedestris (Fallén)	8	1
Drymus brunneus (Sahlberg)	6, 7, 15, 18, 20, 23, 26, 42	17
Miridae		
Lygus wagneri Remane	38	1
Stenodema calcaratum (Fallén)	8	1
Stenodema holsatum (Fab.)	8	1

Cimicidae

Anthocoris species: the most striking feature is the great dominance of *A. nemorum,* admittedly "one of our commoner bugs" (Southwood and Leston, 1959), but here making up over a quarter of all the Heteroptera collected (table 3). The life-cycles of *Anthocoris* species have recently been studied by Ander-

son (1962), in southern England, where numbers of *A. nemoralis* were highest in June when the first generation became adult; other species were most numerous in July. Only *A. nemorum* regularly produced a second generation of any size. In the Lake District in 1954 we found *A. nemoralis* equally abundant in June and July and *A. nemorum* about seven times more abundant in July.

The proportions of different *Anthocoris* species taken in the present survey and by Anderson in Berkshire are given in table 5. *A. nemorum,* which comprised more than a quarter of the entire collection of Heteroptera taken in 1954, appears to enjoy a relatively greater abundance in the Lake District than it does in the South where *A. confusus* is dominant. Observations on the abundance of *Anthocoris* species in other northern districts and years would be of great interest. It is noteworthy that in a survey of a forest area in Poland, Strawinski (1956) found *A. nemorum* to be the commonest member of this genus. *A. confusus, A. nemoralis* and *A. gallarum-ulmi* were recorded but mostly from a botanical garden nearby.

TABLE 5.

The relative abundance of *Anthocoris* species taken by beating various trees in June and July, 1954, in the Lake District and throughout the whole season (1959 and 1960) on oak, sycamore, ash and birch at Ascot, Berks. (after Anderson, 1962).

	Lake District % of total	Berks. % of total
Anthocoris confusus	1·57	73·37
Anthocoris minki	0·87	4·89
Anthocoris nemoralis	4·17	7·93
Anthocoris gallarum-ulmi	0·17	0·11
Anthocoris nemorum	93·22	13·70
Total number of specimens	1150	6569

Microphysidae

Loricula elegantula seemed to be strongly associated with the presence of foliose lichens on the tree trunks, especially with *Hypogymnia physodes* (L.) Wats. (= *Parmelia physodes*). This association has also been noted in Wales where *Parmelia* sp. and the bug were found on stone walls (Scudder, 1956).

Miridae, Bryocorinae

As various Pteridophyta were sampled in every woodland in the July survey a detailed consideration of the Mirids associated with these plants is warranted.

Two species of Mirid are associated with ferns in Britain: *Monalocoris filicis* and *Bryocoris pteridis.* The former species is always fully winged, the latter more commonly (table 6) has reduced wings. *M. filicis* overwinters as an adult and a single,

old, overwintered female was found in the July survey (in leaf litter, Leasgill). The other specimens taken were young adults that had developed from eggs laid in the current season. Numbers of late instar larvae were also found.

B. pteridis overwinters as an egg and becomes adult in late June about a month earlier than *M. filicis*. When adults of this species are collected, females usually greatly outnumber males, and Kullenberg (1946), states that this occurs even in "der Paarungszeit - -, wo ja die Männchen in der grössten Zahl an der Stammlokalen zu finden sind". This was confirmed in the present survey (table 6), with an exception in Longsleddale (site 17), the most northerly of the sites sampled. In this site, the life-cycle seemed to be about one month later than elsewhere, many larvae were still present and the numbers of males and females were virtually equal. It would seem that the males must be very short lived, and that by the time all the larvae have become adults, the oldest males have died.

Although both Kullenberg (1946) and Strawinski (1956) record bracken (*Pteridium aquilinum* (L.)) as a host plant of *B. pteridis* it is clear from table 6 that the numbers of this species on bracken are, in this country, very small, and it seems unlikely that it serves as a larval food-plant here. So far as can be seen from our data, *B. pteridis* has no preferences as between *Athyrium felix-femina, Dryopteris felix-mas, D. spinulosa* and *D. austriaca.*

M. filicis was taken on bracken in numbers, although the mean number per 20 sweeps was lower for bracken (5·9) than for the other ferns (10·8); however, these differences were not statistically significant. In Eggerslack Wood, 10 *M. filicis* but no *B. pteridis* were found on hart's tongue fern (*Phyllitis scolopendrium*). It seems from this study that *M. filicis* has a wider range of hosts within the Polypodiaceae than *B. pteridis.* Some plants of royal fern, *Osmunda regalis* (Osmundaceae) were swept at Rusland Moss; no Mirids were found and there are no records of their occurrence on ferns other than Polypodiaceae.

In contrast to the situation in *B. pteridis,* more males of *M. filicis* were taken than females. Southwood (1960) found the numbers of female *M. filicis* taken in suction traps greatly exceeded the number of males and it may be that the females tend more to fly away from the breeding sites.

Other workers (especially Kullenberg, 1946) have stressed that both these bugs are shade and moisture 'loving', *B. pteridis* more so than *M. filicis.* In the present survey, *M. filicis* was undoubtedly more abundant in the wetter pine and birch woods on the peat mosses than elsewhere. *B. pteridis* was least abundant in the oak woods, on slate, which were the most open of the woodlands surveyed. Site 17, the Longsleddale oakwood mentioned above, where *B. pteridis* was abundant, was exceptional in receiving the highest rainfall.

TABLE 6.

Numbers of Bryocorinae taken in 20 yard sweeps of Pteridophyta

			Pine woods				Birch woods						Oak woods							Mixed ash woods							
	Site		1	2	3	4	5	6	7	9	11	12	13	15	16	17	18	19	20	22	23	24	25	27	30	31	Total
Monalocoris filicis	Bracken	l	0			0	0	0	0	1		0		0	0		0	0	1			0	0	0		0	2
		♂	2			2	1	1	2	22		2		0	0		2	0	5			2	5	4		0	50
		♀	7			1	2	1	0	13		1		1	0		0	1	6			0	4	5		1	43
	Ferns	l	0	4	0	0	0	0	0	0	0	19	0		0	0	0	0		0	0	0	0	0	0		23
		♂	6	26	2	11	5	31	5	10	3	33	4		2	0	2	11		3	1	0	3	1	1		160
		♀	1	5	2	4	7	10	2	4	1	11	1		2	3	1	4		2	7	6	7	2	1		83
		Total	16	35	4	18	15	43	9	50	4	66	5	1	4	3	5	16	12	5	8	8	19	12	2	1	361
Bryocoris pteridis	Bracken	l	0			0	0	0	0	0		0		0	0		0	0	0			0	0	0		0	0
		♂b	0			0	0	0	0	0		0		0	0		1	0	0			0	0	0		0	1
		♀b	0			0	0	0	0	0		0		0	0		0	1	0			0	0	1		0	2
	Ferns	l	0	0	0	0	0	0	0	0	0	0	0		0	14	0	0		0	0	0	0	0	0		14
		♂m	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0		3	0	0		0	0		3
		♀m	0	0	1	1	0	0	0	0	0	0	0		0	0	0	0		0	0	1	1	0	0		4
		♂b	2	1	2	0	1	11	2	3	1	0	0		0	30	0	0		0	0	2	2	0	2		59
		♀b	14	33	10	42	9	48	4	28	16	0	0		0	29	2	8		49	15	17	26	3	19		372
		Total	16	34	13	43	10	59	6	31	17	0	0	0	0	73	3	9	0	52	15	20	29	4	21	0	455

l = larva. m = macropterous. b = brachypterous

Species of fern swept:

Dryopteris austriaca—Sites 1, 2, 3, 4, 5, 9, 11, 12, 13, 16, 17, 18, 22, 23, 25, 27. *D. felix-mas*—Sites 13, 18, 19, 25, 30. *D. spinulosa*—Site 2. *Athyrium felix-femina*—Sites 6, 7, 12, 19, 24.

Phylinae

Psallus species: the British species of *Psallus* were thoroughly revised by Woodroffe in 1957 and the distribution of several of them is imperfectly known. The present survey showed that, as in southern England, *P. perrisi* is by far the most common member of the subgenus *Hylopsallus*; *P. quercus* would seem to be slightly commoner than in southern England and *P. wagneri* rarer. A great contrast with southern England is found with *P. masseei* and *P. diminutus,* a pair of very closely allied species; in the Lake District, the former is apparently the more abundant (one of the few original specimens was taken in Westmorland) and in southern England, the latter.

Saldidae

Chiloxanthus pilosus: although this capture was strictly outside the scope of the survey, it is of interest in slightly extending northwards the known distribution of this species on the west coast; previously the most northern record was from south Lancashire. It has been taken subsequently to our survey a few miles distant on the salt marsh in Roudsea Wood National Nature Reserve.

Comparisons with Southern England

From the experience of one of us (T.R.E.S.), it is possible to make certain comparisons, in general terms, with southern England and from Massee (1954) and Leston (1961) with Kent and Bedfordshire respectively. The following species were more numerous in the Lake District than would have been found in the corresponding habitats in southern England: *Drymus brunneus, Anthocoris nemorum, Bryocoris pteridis, Psallus quercus, Psallus masseei, Mecomma ambulans, Orthotylus tenellus, Lygus wagneri, Miris striatus, Calocoris alpestris* and *Stenodema holsatum.*

In contrast, *Anthocoris confusus, A. nemoralis, Malacocoris chlorizans, Heterotoma planicornis* and *Liocoris tripustulatus* were found less abundantly in the Lake District than would be expected from southern England. The species which were not taken in the Lake District, but which would be expected to be found were such a survey made in southern England, may be grouped as follows: —

(a) Species whose northerly limit in Britain is supposedly southern Yorkshire: *Heterogaster urticae* (Fab.), *Deraeocoris lutescens* (Sch.), *Deraeocoris ruber* (L.), *Macrotylus solitarius* (Mey.-D.), *Orthonotus rufifrons* (Fall.), *Coniortodes salicellus* (H.-S.) and *Megalocelum infusum* (H.-S.).

(b) Species whose northerly limit is supposedly Lancashire: — *Philophorus perplexus* D. & S. only.

(c) Species that are supposedly distributed thorughout Britain: — *Drymus sylvaticus* (Fab.), *Plesiodema pinetellum* (Zeft.), *Phoenicornis* (= *Psallus*) *obscurellus* (Fall.), *Orthotylus virescens* (D. & S.), *Dichrooscytus rufipennis* (Fall.), *Pantilus tunicatus* (Fab.) and *Lygus rugulipennis* Poppius.

(d) Species whose distribution is imperfectly known following taxonomic revision: —*Psallus diminutus* (Kirsch.), *Orthotylus flavinervis* (Kirsch.), *O. ochrotrichus* Fieber and *Lygus maritimus* Wagner.

The Lake District data support existing views on the ranges of the species in groups (a) and (b) and add to what is known of those of group (d). Three of group (c) are pine species and have been recorded from one or both of the two counties (Westmorland and Lancashire) covered by this survey; the sampling of pine was perhaps inadequate. *P. tunicatus* (hosts: hazel, alder and birch) is recorded from Lancashire, but it does not hatch from the egg until July or August and so may be one of the very few species to have been missed because of the timing of the survey. *O. virescens* lives on broom and in south-eastern England it is probably, together with *Asciodema obsoletum,* the most widely distributed broom Mirid; although recorded from Durham, Cumberland and Yorkshire, it has not been found in Westmorland or Lancashire and is probably scarcer in the north than *O. adenocarpi* or *Heterocordylus tibialis,* possibly demanding a more continental type of climate than those species. *L. rugulipennis* is associated more with artificial than natural habitats and its absence may have been due to the type of localities sampled.

Summary

A survey of the Heteroptera of Lake District woodlands and adjacent habitats was made in June and July 1954, supported by collections of overwintering individuals from litter in November 1953. A total of 108 species was recorded; over one quarter of the catch consisted of a single species, *Anthocoris nemorum.*

The different types of woodland (yew, pine, birch, oak and mixed ash wood) have characteristic species of Heteroptera. This is largely a reflection of host plant relationships. The oak woods have a much poorer fauna in terms of individuals and species than mixed ash woods, which are the richest of all the woodland types.

Certain features of interest in the comparative abundance of several Heteroptera in different parts of England emerged from the work. In five groups of allied species, the dominance of one species (*Drymus brunneus, Psallus perrisi, P. masseci, Lygus wagneri* and *Anthocoris nemorum*) and the absence or comparative rarity of others (*D. sylvaticus, P. wagneri, P. diminutus, L. maritimus* and *A. confusus*) was marked. The comparative abundance of other Heteroptera in the Lake District and southern England is commented upon.

The distribution of the fern bugs (Bryocorinae) was studied in detail. *Monalocoris filicis* occurred on a wider range of host plants within the Polypodaceae than did *Bryocoris pteridis*.

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